

United States
Department of
Agriculture

Forest Service

Northeastern Area

Admin. Report
82-10

FOREST PEST MANAGEMENT REPORT

A Survey of Aspen Diseases on the Superior
National Forest, Minnesota-1981

Prepared by:

James W. Walters, Forest Pathologist
St. Paul, Minn. Field Office

ABSTRACT

A total of 1,110 trees in 19 stands of quaking aspen on the Superior National Forest were examined to determine the distribution and abundance of major aspen diseases. The most common disease was white trunk rot (*Phellinus tremulae*), which occurred on 18 percent of the trees sampled. Incidence of this disease increased with stand age from 4 percent in stands 20 to 39 years old to 35 percent in stands 60 or more years old. Except for white trunk rot, disease incidence was very low. Fifteen percent of the sampled trees were dead, with stem breakage identified as the most prevalent mortality factor.

INTRODUCTION

Quaking aspen (*Populus tremuloides* Michx.), bigtooth aspen (*P. grandidentata* Michx.), and balsam poplar (*P. balsamifera*) are important commercial species in the Lake States. Aspen harvesting has substantially increased since the recent construction of waferboard mills in northern Minnesota and Wisconsin. As demand for aspen increases, volume loss caused by diseases will become more important. Although several species-specific disease surveys have been conducted in the Lake States (Anderson 1964, Graham et al. 1963, Marty 1972), the overall importance of aspen diseases was not determined. To identify the extent of aspen disease problems, the distribution and abundance of diseases must be determined. Once this is done, disease severity and associated volume losses can be evaluated.

OBJECTIVE

This survey was done to determine the distribution and abundance of major aspen diseases on the Superior National Forest. Survey results will be used to assess the need for a more intensive evaluation of specific aspen diseases on the Forest.

METHODS

Twenty-five Superior National Forest aspen stands were selected for sampling. The stands were stratified into the following age classes: 20-39 years, 40-59 years, and 60 years or older. Stands less than 20 years old were not sampled. The percentage of stands in each age class was determined and used to apportion sample stands. The number of stands to be sampled in each age class was directly proportional to the total acreage in the age class. After stands were randomly selected from the individual age classes, their accessibility was determined by examining Forest and Compartment maps. A sufficient number of apparently accessible stands were then selected for the field survey.

Two circular 0.1 acre plots from 1 to 8 chains apart were established in each stand. Plot location was based on stand size and shape, distribution of the aspen type, and location of the access point in the stand. On each plot, live aspen or balsam poplar greater than 2.0 inches d.b.h. were sampled. Data collected for live sample trees included tree species, d.b.h., and visible wounds or diseases. When disease diagnosis was uncertain, samples were obtained when possible and brought to the laboratory for identification. Apparent insect injury was noted. The same data was

collected for recently dead trees (i.e., trees that were not easily pushed over and had mostly intact bark) on each plot, except that cause of death replaced visible tree disease notations. Other information collected at each stand included aspect, percent slope, and approximate species composition. Site index information was obtained from stand examination records.

RESULTS AND DISCUSSION

There were three stands to be sampled in the 20 to 39 years class, 13 stands in the 40 to 59 years class and nine in the 60 years and over class. Five stands in the middle and one in the oldest age class could not be sampled due to inaccessibility. A total of 1,110 aspen trees on 38 plots in 19 stands were examined. All sample trees were quaking aspen, except for four plots of bigtooth aspen and one of balsam poplar. Basic stand conditions by age class are summarized in Table 1. Tree diameters of aspen ranged from 2.1 to 20.5 inches. Although basal area (BA) of aspen varied from 55 to 120 square feet per acre, the average for each age class was similar, as was site index, which ranged from 50 to 70 with an average of 61.

Disease Incidence on Live Trees

The incidence of diseases and insects on living aspen trees is summarized in Table 2. The most common disease in all age classes was white trunk rot, which infected 18 percent of the living trees sampled. Incidence of this disease increased with stand age from 4 percent in the young age class to 35 percent in stands 60 or more years old. Many other studies have documented the direct correlation between trunk rot and stand age. Stand breakup due to this disease usually begins at about 45 to 50 years of age (Anderson and Schipper 1978).

Disease incidence was not apparently related to aspect, slope, species composition, or site index. Cankers were not common in any of the stands sampled. The proportion of other diseases and insect borers was about the same in all stands. The percent of trees with dead tops, which increased with stand age, was the second most prevalent problem in stands of 60 years or older. Although some dead tops were associated with Hypoxylon cankers, most had unknown causes. Overall, except for white trunk rot, disease incidence was very low in the stands sampled.

Disease Incidence on Dead Trees

Fifteen percent of the sampled trees were dead. Tree mortality increased with stand age and was 13, 15 and 17 percent for the three age classes. In all but one stand, dead trees had a smaller average diameter than live trees. Diseases associated with tree mortality included Hypoxylon canker, Hypoxylon mammatum Wahl. Mill., Armillaria root rot, Armillaria mellea (Vahl ex Fr.) Kummer, and white trunk rot, Phellinus tremulae (Bond.) Bond. et Boriss. The following tabulation summarizes mortality factors for sampled trees:

Cause of Death

Age Class (Years)	No. Dead Trees	Hypoxylon Canker	Unknown Canker	Windthrow with Armillaria	Broken off at Unknown Canker	Broken off with White Trunk Rot	Broken off not Disease Related	Unknown
20-39	48	15	13	4	4	4	23	38
40-59	64	2	2	2	3	8	41	44
≥ 60	58	3	3	2	5	19	33	34
Total or Average	170	6	5	2	4	11	33	39

*Totals may not equal 100 percent due to rounding.

Unknown factors caused the largest percentage of tree mortality. Since aspen deteriorates rapidly after death, it is difficult to identify the primary cause of death. The most common verifiable mortality factor was stem breakage. Trees in this category were broken off at various heights; breaks were not associated with visible diseases, injuries or defects.

The three categories of stem breakage account for the majority of the tree mortality. Usually, it could not be determined whether breakage occurred before or after the tree died. Trees that were broken off and infected with white trunk rot or an unidentified canker were placed in their respective category only if the break was associated with a canker or conk. The incidence of stem breakage with white trunk rot increased with stand age, a reflection of the increasing occurrence of the disease in older stands.

As in other studies (Anderson 1964), mortality caused by Hypoxylon canker was most prevalent in the youngest age class. The combination of Hypoxylon cankers and unknown cankers accounts for 28 percent of the mortality in stands 20 to 39 years old. Although this seems significant, cankers may be acting as beneficial thinning agents in the younger stands. Basal area calculations for stands in the 40 to 59 year age class indicate adequate stocking of aspen on nearly all sites. Thus, early mortality caused by cankers did not appear to adversely affect aspen stocking in sampled stands.

CONCLUSION

Survey results indicate that white trunk rot is the most widely distributed and abundant disease of aspen on the Superior National Forest.

RECOMMENDATION

Because of the abundance of white trunk rot on the Superior National Forest, land managers should follow current management practices to reduce its impact in affected stands. These management practices include:

1. Harvesting aspen stands on a 40 to 50 year rotation.
2. Maintaining fully stocked stands to facilitate natural branch pruning.
3. Avoiding tree wounds and protecting trees from fire, in order to minimize injuries that provide entry courts for decay fungi.

LITERATURE CITED

- Anderson, Ralph L. 1964. Hypoxylon canker impact on aspen. *Phytopathology* 54:253-257.
- Anderson, Robert L. and A. L. Schipper, Jr. 1978. A system for predicting the amount of Phellinus (Fomes) igniarius rot in trembling aspen stands. U. S. Forest Service Research Note NC-232. 4p.
- Graham, Samuel A., R. P. Harrison, Jr. and C. E. Wesfell, Jr. 1963. Aspens, Phoenix tree of the Great Lakes Region. University of Michigan Press. 272 p.
- Marty, Robert. 1972. The economic impact of hypoxylon canker on the Lake States resources. In Aspen: symposium proceedings. U. S. Forest Service Gen. Tech. Rep. NC-1. 154p.

Table 1.--Basic stand conditions in aspen stands sampled on the Superior National Forest, 1981.

Age Class	Compartment and Stand Number	Average Age	Site Index	Number Live and Dead Trees Sampled	Percent Dead Trees	Live Trees	Dead Trees	Live BA	Dead BA	Mean d.b.h. Live trees	Mean d.b.h. Dead Trees
years		years				-per acre-		-ft ² per-acre		-----inches-----	
20-39	71-33	34	65	100	23	385	115	80	12	5.8	4.2
	99-33	38	55	108	17	450	90	88	10	5.8	4.1
	7-76	26	60	153	5	730	35	87	4	4.5	4.2
Total or Average		33	60	361	13	522	80	85	9	5.4	4.2
40-59	45-29	42	60	53	15	225	40	99	9	8.7	5.8
	9-7	52	70	60	17	250	50	120	15	8.8	7.1
	229-24	57	66	39	5	185	10	109	5	10.2	9.0
	245-10	54	60	74	14	320	50	111	10	7.9	5.7
	64-2	57	64	36	22	140	40	82	15	10.1	8.2
	42-46	48	70	53	21	210	55	81	10	7.9	5.2
	10-9	51	50	46	26	170	60	60	12	7.8	5.9
	182-3	58	69	55	5	260	15	78	1	7.1	4.3
Total or Average		52	64	416	15	220	40	93	9	8.6	6.4
≥ 60	58-32	63	60	44	18	180	40	67	16	7.7	8.2
	71-19	62	60	29	21	115	30	55	9	8.8	6.6
	146-1	76	56	45	9	205	20	115	7	10.1	7.6
	142-2	72	60	31	13	135	20	92	8	10.3	8.6
	37-6	67	60	43	12	190	25	101	12	9.7	9.2
	49-40	61	60	49	20	195	50	87	10	8.9	5.9
	4-20	66	55	59	25	220	75	58	16	6.8	6.1
	101-14	108	60	33	18	135	30	106	16	11.8	9.6
Total or Average		72	59	333	17	159	49	85	12	9.3	7.7

Table 2--Incidence of diseases, insects and wounds on live aspen trees,
Superior National Forest, 1981.

Age Class (Years)	Compartment and Stand Number	Number of Live Trees	Hypoxylon Canker	Nectria Canker	Unknown Canker	White Trunk Rot	Butt Rot	Bark Splits	Dead Top	Insect Borers
20-39	71-33	77	4	4	4	8	1	3	1	3
	99-33	90	3	0	0	6	1	1	0	0
	7-76	146	3	1	2	1	0	0	0	1
	Total	313	3	1	2	4	≤ 1	1	< 1	1
	or Average									
40-59	45-29	45	0	0	4	7	0	0	2	4
	9-7	50	2	0	0	10	0	0	10	0
	229-24	37	0	0	0	27	0	1	5	0
	245-10	64	2	0	2	31	2	2	3	2
	64-2	28	7	11	0	14	0	0	0	0
	42-46	42	0	0	0	7	17	17	2	2
	10-9	34	0	0	3	35	0	12	3	0
	182-3	52	2	2	0	15	0	2	6	0
	Total	352	1	1	1	18	2	4	4	1
	or Average									
≥ 60	58-32	36	0	3	3	17	3	11	17	8
	71-19	23	4	13	4	22	0	0	0	4
	146-1	41	5	0	5	29	0	7	5	2
	142-2	27	0	0	4	41	0	0	7	4
	37-6	38	0	0	0	29	3	0	5	0
	49-40	39	0	0	3	51	0	5	8	0
	4-20	44	0	0	0	27	2	2	5	0
	101-14	27	0	0	4	70	0	4	7	0
	Total	275	1	1	3	35	1	4	7	2
	or Average									
Grand Total or Average		940	2	1	2	18	1	3	4	1